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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/039,438	03/16/1998	WOO-SUP SHIN	041992-5037	9576

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EXAMINER
ZERVIGON, RUDY

ART UNIT	PAPER NUMBER
1763	41

DATE MAILED: 05/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/039,438	SHIN ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on February 12, 2003 and March 20, 2003 are entered. The following action is a reply to the amendment filed March 20, 2003.

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 2, 7, 10, 11, 13, 14, 17-22, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat. 4,147,581) in view of Chung et al (U. S. Pat. No. 5,000,795) and Kanda (U.S.Pat. 4,338,157). Nelson discloses an etching process and apparatus for chemically etching[1] (reduction in thickness) material from a substrate (column 1, lines 40-68; Figure 1). An etched product ("solid"; column 4, lines 40-50) is etched in unit 2 (Figure 1) thereby at least contacting the solid with the aqueous liquid (first etchant – "etching solution"; column 4, line 43; column 2, lines 45-69) including HF (abstract) and the resulting liquid (residual etchant of stream 3, Figure 1; column 4, lines 58-60) is passed through an ion

exchanger (11, Figure 1; "separation tank"; column 4, line 67-column 5, line 16) to remove the ions from the rinse liquid which is reused or discharged (30, 16; Figure 1). The solids (residue materials) are removed from an etcher ("etch bath") (2) via a stream (3) which passes into a rinse chamber (a second tank; 4; Fig. 1; col. 4, lines 49-68) including outlet pipe (6; column 4, lines 55-57). The rinse liquid stream (7) then goes through an ion exchanger means (11). A replenishing solution (30) from the ion exchange means is combined (31) with the stream (22) of a bulk storage tank (20; 1st Tank; column 5, lines 35-40) to form a combined stream (31) going to the etcher (2; col. 5, lines 35-55). The bulk storage tank (20) has streams flowing to the etcher (2) for etching the product and to the ion exchange means (11) in order to regenerate the resin. Stream (12) from the ion exchanger (11) moves to a discharge stream (16), which passes to a sewer. (Col. 5, lines 5-10). The etcher (2) can be a spray etcher which would inherently have nozzles (col. 4, line 40).

Nelson does not disclose an immersion of a substrate in an etched bath or a bubble plate used therein.

Chung et al disclose a bubble plate (17) located on the floor of a tank (10; Fig. 1). The bubble plate (17) transmits inert gas to create a bubbling condition within the tank (10) for sufficient agitation (col. 1, lines 60-68). Silicon substrates (14; column 3, lines 44-48) are immersed in an etch bath ("hot sulfuric acid"; 13; Fig. 2; col. 2, lines 25-38; column 3, lines 44-48).

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[1] Etch – 1a: to produce (as a pattern or design) on a hard material by eating into the material's surface (as by acid or

At the time of the invention it would have been obvious to a person of ordinary skill in the art to replace the spray etcher of Nelson with the etch bath and bubble plate of Chung et al.
The motivation for doing so would be to replace the etchant delivery means (ie, sparger etcher) with an alternate and equivalent etching means (ie a bath etcher).

Nelson and Chung et al do not teach a temperature sensor and control unit.
Kanda et al disclose a process control system (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) having a thermocouple for measuring the temperature of the etching solution (8, Figure 2; column 9, lines 22-23) used to etch a submerged substrate (2, Figure 3). Kanda specifically teaches a control unit (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) for receiving a signal indicating the temperature (T) of the etchant from a temperature sensor ("thermocouple") and transmitting an etching termination signal ($P \simeq 0$) to the etch bath when the temperature reaches a target temperature. Further, Kanda teaches the etched thickness (Q; column 10, lines 10-15) of the substrate is derived from the temperature (T) of the first etchant.
Nelson, Chung, and Kanda do not teach using the total reaction energy as a reference.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to control the etching operation for the etching apparatus of Nelson with the chemical processing control system of Kanda including using the total reaction energy as a reference by replacing Kanda's temperature in any of Kanda's "Q" equations (column 10) with "reaction energy" as

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laser beam). Merriam-Webster's Collegiate Dictionary - 10th Ed. p.398

derived from the well know thermodynamic relationship between molar enthalpy (per unit mass), heat capacity, and temperature[2]:

$$\frac{\partial H}{\partial T} \equiv c_p$$

The motivation for controlling the etching operation for the etching apparatus of Nelson and Chung et al with the chemical processing control system of Kanda, using "reaction energy", would have been to detect the termination of etching appropriately and precisely as taught by Kanda (column 10, lines 44-47) by an alternate a equivalent means of detecting said termination in using "reaction energy".

Therefore, it would have been obvious to a person of ordinary skill in the art to combine Nelson with Chung et al and Kanda to obtain the invention.

3. Claims 3-6, 8, 9, 12, 15, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat.4,147,581) in view of Chung et al (U.S.Pat.5,00,795) and Kanda (U.S. Pat. No. 4,886,590), and further in view of Jones et al (U.S. Pat. No. 3,869,313).

Nelson, Chung, and Kanda are discussed above.

Nelson, Chung et al, and Kanda do not disclose expressly a rinse and drying bath for the substrate.

As to claims 3-5, 8, 9, and 12, Jones et al disclose a chemical processing apparatus containing a plurality of treatment chambers having a dip chamber with filling pumps, a spray chamber which serves as a rinse chamber or a drying chamber (col. 2, lines 20-39 and 63-68; col. 3, lines 1-10). The rinse chamber would be filled with deionized water from a deionized reservoir (col. 2, lines

[2] As demonstrated (MPEP 2116.01) in Physics for Scientists & Engineers, 2nd Ed. R.A. Serway, Saunders College Publishing, 1986. pp. 428 (see top-most equation).

52-55). An essential part of the apparatus is a conveyor means for automatically transferring the workpieces from treatment chamber to treatment chamber. (Fig. 1; Col. 3, lines 50-55). The conveyor allows for a plurality of substrates to be processed substantially at the same time. Using a pump to move fluid from one chamber to another is conventional. Jones further teaches a "controlled heater 67" (column 2, lines 28-35) used in the "treatment" chamber that "may be used as a drying chamber" (column 3, lines 1-3).

As to claim 6, Jones et al disclose a cleaning/etching solution containing hydrofluoric acid (col. 5, lines 49-60; col. 6, lines 33-35 and 51-54). Jones et al disclose cone shaped bottom tanks (Figs. 6A-B).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the multiple chambers for rinsing and drying of Jones et al with the etching apparatus of Nelson, Chung et al, and Kanda.

The motivation for doing so would have been to provide treating operations such as rinsing and drying of substrates as taught by Jones et al.

1. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat. 4,147,581), Chung et al (U. S. Pat. No. 5,00,795), and Kanda (U.S.Pat. 4,338,157), and further in view of Tittle (USPat. 4,886,590). Nelson, Chung, and Kanda are discussed above. However, Nelson, Chung, and Kanda do not teach a concentration measuring device of the first etchant.

Tittle teaches a concentration ("characteristic"; column 1, lines 31-36; column 2, lines 17-22) measuring device ("sensors", "chromatograph"; column 1, lines 65-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Nelson, Chung , and Kanda to add a concentration measuring device as taught by Tittle to his endpoint detection system.

Motivation for Nelson, Chung , and Kanda to add a concentration measuring device as taught by Tittle to his process control system is for monitoring when the rinsing solution should be changed or cleaned (column 1, lines 39-41).

Response to Arguments

4. Applicant's arguments filed March 20, 2003 have been fully considered but they are not persuasive.

5. Applicant is referred to the body of the claim rejections above reflecting modified rejections as a result of the amendments filed March 20, 2003.

Conclusion

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

JEFFRIE R. LUND
PRIMARY EXAMINER